

**HYDROGEOLOGIC INVESTIGATION INTERIM REPORT  
FOR  
CHRYSLER CORPORATION'S  
TRENTON CHEMICAL FACILITY  
TRENTON, MICHIGAN**

**VOLUME I OF II**

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## 1.0 INTRODUCTION

The following report has been prepared for Chrysler Corporation by Hart Engineers, Inc. (HART) to summarize the results of Phase I of the Hydrogeologic Investigation conducted by HART at Chrysler's Trenton Chemical Facility. The major objective of the subject investigation as stated in the Work Plan submitted to Chrysler on August 6, 1987 was to determine if past on-site disposal practices have resulted in ground water degradation.

In order to maximize the information generated from a site with a limited pre-existing hydrogeological/geological data base in a cost effective manner, the investigation was designed to be implemented in two (2) phases. Phase I was designed to review any available existing data as well as develop preliminary site specific information necessary to begin to characterize the geologic environment and ground water flow system as a pathway for waste constituent transport. Phase II was designed to generate supplemental data necessary to define the horizontal and vertical extent of waste constituent transport in the ground water pathway. Overall, Phases I and II will provide the necessary information to complement the previous investigations so as to develop a thorough characterization of the source area, pathway(s) and receptor(s) at the Trenton Chemical Site.

The purpose of this report is twofold: 1) to review the objectives and results of the Phase I investigation and 2) to provide recommendations for supplemental information necessary to complete the investigation in Phase II.

## Background

The initial subsurface source area investigation at the Trenton Chemical Facility was conducted by HART from January through April, 1987. The investigation included a geophysical survey, soil sampling from test excavations in the backlot area and the installation and sampling of monitoring wells in the shallow, unconsolidated deposits overlying bedrock. The geophysical survey, including gravity and magnetic surveys, was conducted in the backlot area to delineate areas of waste disposal. Excavations were placed to confirm the source of magnetic and/or gravity anomalies and soil samples were collected from the excavations to evaluate the extent of waste disposal units.

The excavation and sampling indicated that drum burial and surface disposal of wastes had occurred in portions of the backlot area, resulting in soil to waste contact in the immediate vicinity of the disposal sites. The potential for impacts to ground water in the unconsolidated material was indicated because buried waste was in direct contact with ground water. Furthermore, the potential for migration to the underlying limestone bedrock existed.

The source area investigation identified five (5) areas in the southern portion of the backlot where containerized and bulk waste disposal had occurred. Laboratory analysis of waste materials indicated that volatile and semi-volatile compounds, in addition to metals, were present in the subsurface in buried containers and as bulk waste.

Data from four (4) existing shallow monitoring wells installed during the preliminary site investigation of the Trenton Chemical Facility was insufficient to adequately characterize the hydraulic characteristics or water quality of the shallow, unconsolidated material and did not provide any data to evaluate the characteristics of the bedrock. Upon Chrysler's request, HART developed a proposal and Work Plan for a Hydrogeologic Investigation designed to address such issues. The specific objectives of the investigation were as follows:

1. Assess the ground water quality within the shallow, unconsolidated geologic and fill material by sampling the soil and ground water from four (4) to eleven (11) shallow monitoring wells and borings.
2. Assess and evaluate the hydraulic characteristics and ground water quality within the bedrock by installing and sampling the ground water from seven (7) to fifteen (15) deep monitoring wells.
3. Determine whether the unconsolidated and bedrock units comprise a single aquifer and if not, assess the vertical hydraulic relationship and potential contaminant pathways between the two.
4. Characterize quantitative and qualitative ground water quality and determine the nature, extent and sources of contamination, if any.

As stated previously, Phase I included a preliminary data assessment, the installation of shallow and deep monitoring wells and soil and ground water sampling and analysis. This document constitutes a complete report of Phase I activities and a preliminary assessment of the objectives stated above. In the final section of this report, HART has identified areas for which the collection of additional data may be warranted and has recommended specific revisions to the existing Phase II Work Plan.

## 2.0 GEOLOGIC AND HYDROGEOLOGIC SETTING

The Chrysler Trenton Chemical Facility is located in eastern Michigan along the Detroit River. Geologically, it is situated on the Erie-Huron lowland along the southeast margin of the Michigan Basin. The site is underlain by Middle Devonian Age Dolomites and dolomitic limestones of the Detroit River Group. The regional dip of the strata is to the northwest, toward the center of the Michigan Basin. At the Trenton Chemical location, the bedrock varied from sandy brown dolomite to dolomitic limestone. In places the rock was highly weathered and solution voids were common. Fracture zones were present throughout the rock with the highest density of fractures present near the river. Brecciated and intraclastic zones were also observed, but these did not appear to be extensive. The structure contour map of the bedrock surface (Drawing E-1) shows a bedrock high near the center of the northern boundary of the site and a low in the southeast corner.

Overlying the bedrock is unconsolidated glacial drift and fill. The glacial drift is part of the Erie Glacial Lobe and varies from gray to reddish-brown to brown sandy or silty clay with gravel-size rock fragments. The fill material is primarily a mixture of soil and construction debris, varying from yellow-brown to dark brown silty sand with cement, glass, wood and other materials. The fill material is present in the backlot area of the facility, nearest the river.

The hydrogeologic conditions at the Trenton Chemical Site are complex and a detailed analysis and characterization with only the existing data is not possible. Water level data has been collected from wells screened in the unconsolidated material and in the bedrock, as well as from the Detroit River. Table 1 summarizes the existing data to date. Water table contours were constructed from water level elevation data for the wells completed in the unconsolidated material (Drawing E-2) and for those completed in the bedrock (Drawing E-3). The closeness of water levels between the two units, highlighted by the similarity of the piezometric contour patterns, indicates that the units are hydrogeologically connected, existing as a single, unconfined aquifer.

TABLE 1:  
WATER LEVEL ELEVATIONS

WELL	ELEVATION TOP OF PVC CASING*	Date of Readings						
		12/29/87	12/30/87	1/27/88	1/28/88	1/29/88	3/11/88	4/11/88
W-1	581.11	569.03	569.78	570.45	570.55	570.62	---	571.32
W-1	581.38	569.92	569.88	569.60	569.60	569.60	569.73	569.54
W-2	585.49	572.99	573.32	572.50	572.58	572.67	572.94	573.30
W-2	585.57	572.99	573.24	572.42	572.51	572.71	573.02	573.20
W-3	584.08	577.00	577.00	575.21	576.43	576.44	576.73	576.78
W-3	583.94	575.52	575.73	576.29	575.09	575.28	575.44	575.24
W-4	582.88	573.92	574.05	573.50	573.78	573.66	---	573.62
W-4	582.66	573.91	573.99	573.49	573.79	573.69	573.81	573.79
W-6	579.37	574.70	574.87	574.26	574.15	574.14	575.10	574.61
W-6	579.26	573.84	573.84	573.60	573.54	573.57	574.14	573.83
W-8	588.49	574.41	574.07	573.60	573.56	573.68	573.68	573.69
W-8	582.75	574.08	574.33	573.79	573.82	574.00	574.05	568.13
W-9	587.96	574.96	575.13	574.63	574.65	574.87	574.76	574.84
W-9	587.10	573.39	572.79	572.79	572.94	573.00	573.10	574.10
W-14	589.02	574.44	574.48	573.98	573.96	574.06	574.12	573.82
W-14	589.15	573.98	574.15	573.65	573.79	573.84	573.90	573.70
P-1	584.33	575.75	575.83	575.46	575.46	575.50	575.53	---
Reference Elevation								
Staff Gauge	577.04							
				573.46	573.72	573.71	573.77	---
Water Out- let Valve	580.00							
				573.32	573.63	573.75	573.78	---

\* Elevation reported in feet above mean sea level.



The water table contour maps (E2 and E3) indicate the presence of a "ground water high" in the central portion of the site. The hydraulic gradient decreases away from this area toward the Detroit River at a gradient of 0.25 to 0.5%. The hydraulic gradient also decreases from the central high toward the northwest. Without additional seasonal water level information, it is not possible to further characterize the significance of this feature. Existing published geologic information does indicate that the subject study area is located near areas of artesian ground water flow conditions and may represent localized ground water discharge from the bedrock to the overlying unconsolidated materials. The feature may also be an artifact of past river stage fluctuations or may be related to the ground water mounding caused by site specific features.

Water quality data collected during this investigation further supports the indicated direction of ground water flow from the central portion of the Trenton Chemical Facility through the backlot toward the Detroit River. Monitoring wells MW-3 and MWD-3 are located hydraulically upgradient of the backlot and the related waste disposal units. Water quality data collected from these wells does not indicate that waste constituents have migrated from the backlot area to the northwest. The data does, however, indicate that constituents have migrated from the backlot toward monitoring wells 9 and 14.

### 3.0 FIELD INVESTIGATION PROCEDURES

Phase I of the field investigation at the Trenton Facility was conducted under the supervision of HART geologists between November 17 and December 30, 1987. The work included the drilling of five (5) shallow test borings advanced to the bedrock surface, and eight (8) borings advanced approximately fifteen (15) feet into bedrock.

The shallow borings were advanced using seven and three-quarter (7 3/4) inch O.D. Hollow Stem Augers, which were steam-cleaned prior to beginning each boring. Soil samples were collected in advance of the augers at three (3) foot intervals using a twenty-four (24) inch split barrel sampler driven by a one hundred forty (140) pound hammer dropped thirty (30) inches as prescribed by ASTM D-1586. Prior to each sampling, the split barrel sampler was decontaminated to prevent cross contamination of samples. Sample descriptions including penetration resistance, recovery, lithology, grain size and any other salient features and observations were recorded on the boring logs (Appendix A). Additionally, each sample was scanned with an OVA to identify zones of contamination and readings were noted on the boring logs.

Monitoring wells were constructed in four (4) of the shallow borings using two (2) inch I.D. Schedule 40 PVC riser with five (5) or ten (10) feet of machine cut 0.01 inch slotted PVC well screen at the bottom of each one. The borings were backfilled with silica sand to at least two (2) feet above the top of the screen. Two (2) feet of pelleted bentonite was placed into each boring and allowed to hydrate thoroughly before grouting the borings to one (1) foot below ground surface with a cement-bentonite slurry. Steel protective casings with locking caps were cemented in place over each well. Specifications of the individual well constructions are presented in Table 2. Well construction diagrams are provided in Appendix B.

Boreholes that were not completed as monitoring wells were sealed by grouting with a cement bentonite slurry pumped to the bottom of borehole using a tremie tube.

TABLE 2: WELL CONSTRUCTION SPECIFICATIONS

WELL	SURVEYED ELEVATION TOP OF PVC*	STICK UP (FT)	GROUND* SURFACE ELEVATION	TOTAL DEPTH (FT)	SCREENED INTERVAL (DEPTH IN FEET)	UNIT SCREENED	SCREEN LENGTH (FT)	SCREEN SLOT SIZE (In.)	WELL INNER DIAMETER (In.)	CASING/SCREEN MATERIAL
MW-1	581.11	2.4	578.7	12.5	7.4-12.4	Silty clay	5	0.01	2	Sch. 40 PVC
MWD-1	581.38	2.5	578.9	27.0	15-25	Dolomitic Limestone	10	0.01	4	Sch. 40 PVC
MW-2	585.49	2.0	583.5	14.5	9.5-14.5	Clayey Silt	5	0.01	2	Sch. 40 PVC
MWD-2	585.57	2.15	583.4	27.5	16-26	Dolomitic Limestone	10	0.01	4	Sch. 40 PVC
MW-3	584.08	2.3	581.8	14.0	8-13	Silty clay	5	0.01	2	Sch. 40 PVC
MWD-3	583.94	2.3	581.6	30.5	18.85-28.85	Dolomitic Limestone	10	0.01	4	Sch. 40 PVC
MW-4	582.88	2.5	580.4	14.0	8-13	Silty Clay	5	0.01	2	Sch. 40 PVC
MWD-4	582.66	1.7	580.9	31.45	20.3-30.3	Dolomitic Limestone	10	0.01	4	Sch. 40 PVC
MW-6	579.37	2.3	577.1	11.5	5.4-10.4	Sandy Clay	5	0.01	2	Sch. 40 PVC
MWD-6	579.26	2.2	577.1	26.3	15.5-25.1	Dolomitic Limestone	10	0.01	4	Sch. 40 PVC
MW-8	588.49	2.7	585.5	19.0	8.9-18.9	Clay and Silt	10	0.01	2	Sch. 40 PVC
MWD-8	588.75	2.3	586.5	36.5	25.7-35.7	Dolomitic Limestone	10	0.01	4	Sch. 40 PVC
MW-9	587.96	2.2	585.8	17.0	9.9-19.9	Silt and Clay	10	0.01	2	Sch. 40 PVC
MWD-9	587.10	2.5	584.6	36.0	23.4-33.4	Dolomitic Limestone	10	0.01	4	Sch. 40 PVC
MW-14	589.02	2.0	587.0	19.0	8.5-18.5	Silty Sand & Clay	10	0.01	2	Sch. 40 PVC
MWD-14	589.15	2.2	587.0	35.5	26.2-36.2	Dolomitic Limestone	10	0.01	4	Sch. 40 PVC

\* Feet above Mean Sea Level

The bedrock borings were cored using a four and one-half (4 1/2) inch diamond bit with a one and seven-eighths (1 7/8) inch core barrel. For these borings, the overburden was augered through continuously without sampling. Core samples were collected and detailed descriptions were recorded on the rock core logs (Appendix A).

Packer testing was performed upon select rock core holes to assess the potential for preferred contaminant migration through fracture zones in the bedrock. The test was performed by installing inflatable packers in each core hole in such a way that fractured zones and unfractured zones were sealed off from one another. Each sealed zone was pumped for approximately 10 to 15 minutes in order to obtain a ground water sample representative of the particular hydrogeologic zone within the aquifer. At the end of the pumping cycle, a ground water sample was collected in pre-sterilized VOA vials provided by the laboratory. The sample was placed on ice while the packer test was performed upon the remaining fractured or unfractured zones within a single core hole. Once all of the samples were assembled for each core hole, the sample vials were heated in a water bath to a temperature of approximately 50°C for ten (10) minutes. Each sample was injected into an Organic Vapor Analyzer (OVA) for gas chromatograph (GC) analysis of organic vapor concentrations. The results were then used to determine if organic constituents were more strongly associated with the fractured zones so that the well construction specifications could be modified as needed.

Zones with varying amounts of fracturing, solutioning and weathering were observed and were packer tested in boreholes MWD-1, MWD-2, MWD-3, MWD-4, MWD-6 and MWD-14. Rock core obtained from core holes MWD-8 and MWD-9 was so heavily fractured, solutioned and weathered throughout the interval penetrated, that packer testing was not performed.

A significant difference in organic vapor concentrations between zones within a single core hole was observed for only one of the borings, MWD-6. The upper weathered zone produced water with an organic vapor concentration of 22 ppm while the deeper, solutioned zone produced water with an organic vapor concentration of 600 ppm. However, due to instrument malfunction, the two (2) samples could not be analyzed immediately after the packer testing was

performed. At that time, all of the other bedrock borings had been drilled and packer tested and no significant difference between fractured and unfractured ground water quality was observed. In order to avoid suspending field work for two (2) days awaiting a replacement OVA, HART decided to install a standard ten (10) foot well screen in MWD-6.

Because no significant variations in organic vapor concentration were observed in different zones with any of the other core holes, standard ten (10) foot length well screens were installed. Each of the bedrock monitoring wells were constructed of four (4) inch I.D. Schedule 40 PVC. The well screens were set approximately fifteen (15) feet into bedrock. The remaining well completions were performed in a manner identical to that described for the shallow monitoring wells. Each well's specification are included in Table 2 and diagrams are provided in Appendix B.

All of the wells were constructed so that the top of the PVC riser is approximately two (2) feet above ground surface. Historical stage data for the Detroit River has indicated that the top of the well risers and protective casings are safely above past maximum river stage levels.

In order to determine the influence of the Detroit River upon the ground water flow regime at the Trenton site, two river stage monitoring points were established. The L-shaped staff gauge design presented in the Proposal dated September 3, 1987 was not feasible. A very large gauge would be required in order to continue to measure the water level during periods of low river stage. Instead, the existing concrete pad above the water intake valve was surveyed and differential river stage measurements were made from the concrete pad. A second river stage monitoring point was installed in the protected area where the non-contact cooling discharge water drains into the Detroit River. A boring was drilled off the edge of the bluff and a staff gauge was set in concrete in the boring. A point on the gauge was marked and surveyed and differential river stage measurements are made from that point. River stage elevations are provided in Table 1 with the well water level elevations.

Wells were developed by surging filtered, compressed air into the screened zone. Once the water overflowing the well became clear, the compressor was cycled off and on several times to induce the movement of fines through the screen. Each well was developed until the water was clear.

#### 4.0 SAMPLING AND ANALYTICAL PROCEDURES

One of the primary objectives of the hydrogeologic investigation was to assess the nature and magnitude of ground water contamination, if any, at the Trenton Facility. This was accomplished by first collecting soil and water samples from key site locations and then selectively analyzing these samples for the proper parameters. The methodologies and protocols employed in collecting and analyzing the samples from the Trenton facility are discussed below. In order to ensure the quality of the data obtained, a full Quality Assurance/Quality Control (QA/QC) program was developed and implemented. A description of this program is provided in Appendix C.

##### Soil Sampling

Soil samples were collected at three (3) foot intervals from selected borings using twenty-four (24) inch split spoon samplers. Split spoon samplers were decontaminated prior to each sampling interval by first scrubbing with Alconox (or equivalent) detergent, rinsing with water then methanol, allowing to air dry, rinsing with a 10% nitric acid solution and a final deionized water rinse.

Upon retrieval of the split spoon, each sample was field screened with a Foxboro Organic Vapor Analyzer (OVA) and visually examined for evidence of contamination. The sample was then transferred to an appropriate sample container and all pertinent field information was recorded in a log book. A maximum of two (2) samples per boring were submitted for analysis. Visual observations and OVA readings were used to select the samples for laboratory analysis.

##### Ground Water Sampling

After the new wells were sufficiently developed, ground water samples were collected from the new wells and the four (4) existing wells installed in January, 1987. A minimum of three (3) well volumes were evacuated by bailing or pumping immediately prior to sampling. Ground water samples were collected using decontaminated PVC bailers. Samples were transferred from the bailer

directly into pre-labeled, sterilized sample containers provided by the laboratory and were immediately preserved, as appropriate.

### Analytical Methods

All samples submitted to Wadsworth/Alert Laboratories were analyzed for parameters identified in the Hazardous Substance List (HSL). A complete listing of the specific individual parameters may be found in the U.S. Environmental Protection Agency's Contract Laboratory Protocols (updated October 1986). The general categories of the parameters and corresponding analytical methods and method references are presented in the table below.

#### ANALYTICAL METHOD SUMMARY TRENTON CHEMICAL FACILITY

<u>Parameter</u>	<u>Method</u>	<u>Method Reference</u>
Volatiles	8240	Test Methods for Evaluating Solid Waste, Chemical/Physical, USEPA SW-846
Semi-Volatiles (BNA) <sup>1</sup>	8270	
Pesticides	8080	
PCB's	8080	
Metals	7000	
Cyanide	9010	

<sup>1</sup> Base/Neutral and Acid Extractable Compounds

### Data Validation

Data validation was performed in order to fully understand the usefulness of the data generated as part of this investigation. In this way, the validity of a specific data point was considered in concert with the numerical value and any other salient observations to provide the best understanding possible of site conditions.



When applicable the U.S. Environmental Protection Agency's Laboratory Data Validation Functional Guidelines were employed to evaluate the analytical data. Although these guidelines were originally established in order to validate data generated in accordance with Contract Laboratory Protocols (CLP) they are also a useful tool in establishing the validity of data generated under less stringent QA/QC methodologies.

The samples collected as part of this investigation were not analyzed as part of a CLP program. However, a very high degree of QA/QC was employed as part of the analytical protocols and key quality assurance parameters were incorporated to ensure that this level was maintained. These parameters were:

- o Holding Times
- o Blanks
- o Surrogate Recoveries
- o Matrix Spikes

These parameters were identified and examined for each sample.

#### Holding Times

Technical requirements for holding times have only been established for water matrices. No holding time requirements have been established for soils except when employing Contract Laboratory Protocol (CLP). Therefore, water holding times are commonly adopted for soils. When performing soil analyses using SW-846 methods, holding times are merely recommended.

#### Blanks

The assessment of results of blank analyses is for the purpose of determining the existence and magnitude of contamination problems. The criteria for evaluation of blanks applies to all blanks, including reagent blanks, method blanks, field blanks, etc. The responsibility for action in the

case of unsuitable blank results depends on the circumstances and the origin of the blank. If problems with any blank exist, all data associated with the case must be carefully evaluated to determine whether or not there is an inherent variability in the data for the case, or the problem is an isolated occurrence not affecting other data. The only in-house blank the laboratory reported information on was the instrument/method blank.

Blanks must contain less than five (5) times the Contract Required Detection Limit (CRDL) of methylene chloride, acetone, toluene, and 2-butanone (MEK). Blanks must also contain less than CRDL of all other HSL compounds. For the analysis of semi-volatile and/or pesticide HSL compounds, blanks must contain less than five times the CRDL of any HSL phthalate ester and less than CRDL of other HSL compounds.

In every instance concentrations of the specific HSL analytes were below the method detection limit for the in-house laboratory blanks. However, in two (2) water samples low levels of two (2) phthalate esters were identified. Phthalate esters are common laboratory artifacts found in many plastics and latex gloves. Therefore, it is likely that the identification of these two (2) compounds in site water samples is a result of laboratory exposure and is not related to their presence in the environment under study.

#### Surrogate Recovery

Laboratory performance on individual samples is established by means of spiking activities. All samples are spiked with surrogate compounds prior to sample preparation. The evaluation of the results of these surrogate spikes is not straightforward. The sample itself may produce effects due to such factors as interferences and high concentrations of analytes. Since the effects of the sample matrix are frequently outside the control of the laboratory and may present relatively unique problems, the review and validation of data based on specific sample results is frequently subjective and demanding of analytical experience and professional judgement.

Requirements for Surrogate Recovery are as follows:

1. Upper and lower percent recovery limits are established in the Contract. These limits may be updated from time to time. Refer to the appropriate contract for applicable criteria.
2. If sample surrogate recoveries do not meet criteria, the affected fraction should be re-purged, re-injected, or re-extracted to establish whether the non-conformance was due to the sample matrix or to a laboratory problem.
3. If blank surrogate recoveries do not meet criteria, re-purging, re-injection, or re-extraction of all associated samples is required to establish the existence of matrix effects.

Surrogate recoveries for all samples analyzed met with established control limits if not initially then upon secondary analysis, unless otherwise documented by the laboratory,

Several of the semi-volatile (BNA) samples had surrogate recoveries that were "out of control" (outside established control limits) and not re-extracted or re-analyzed. BNAs are a special case in that no action is taken on samples with surrogate recoveries "out of control" unless two or more recoveries are out of specification for a single sample or unless any surrogate has a less than ten percent recovery. Therefore, the surrogate recoveries for this case are "in control" and the data should be considered to be valid.

#### Matrix Spike

This data is generated to determine long-term precision and accuracy of the analytical method on various matrices. This data alone cannot be used to evaluate the precision and accuracy of individual samples. In accordance with the matrix spike data presented by the laboratory, no long-term deficiencies in either precision or accuracy can be related to matrix effects.

Summary

Upon evaluating the data as a whole using the QA/QC parameters made available by the laboratory, there is no reason to consider the data set suspect. Specific samples and/or blanks may contain discrete suspect information. If so, it has been noted within this report or in the data packages prepared by the laboratory.

## 5.0 RESULTS AND DISCUSSION

### Soil Analytical Data

Raw data for the soils analyses is provided in Appendix D. A summary of the organic and cyanide data is presented in Table 3. Organic compounds were generally undetected in the soil samples. Only one sample, BH-11 (8-10) contained a detectable concentration of the volatile organic compound chlorobenzene at 2 mg/kg. No acid or base-neutral compounds, pesticides or PCBs were detected in any of the soil samples. However, the detection levels for samples MW-9 (6-8) were elevated as a result of interferences. The library search, performed as a part of the organics scan, detected low concentrations, estimated at 10 mg/kg, of unknown compounds in samples BH-11(5-7), MW-8(17-19) and MW-14(14-16). Molecular sulfur was tentatively identified at estimated concentrations of 10 to 20 mg/kg in samples MW-8(17-19), MW-14(11-13) and MW-14(14-16).

Total cyanide concentrations were detected above the expected background concentrations in the soil sample from boring MW-8 and in both samples from borings MW-9 and MW-14. Cyanide concentrations of 6.7 and 3.4 mg/kg were observed in sample MW-9(6-8) and MW-14(14-16), respectively. A slightly elevated cyanide concentration of 0.6 mg/kg was reported in the duplicate split of sample BH-11(5-7). However, no cyanide concentrations above the detection limit of 0.5 mg/kg were observed in the other half of sample BH-11(5-7) indicating that the cyanide concentration may be approximately at the detection limit for this sample.

A summary of the metals analytical data is presented in Table 4. Prior to implementing the investigation, borings MW-6 and MWD-6 were tentatively identified as background or upgradient. Analytical results indicate that soil samples from MW-6 may indeed provide background constituent concentrations. Additionally, total metals concentrations have been compared to data developed by the Waste Management Division of the Michigan DNR (Appendix E). According to DNR maps, the Trenton Chemical Plant is located in the Erie Glacial Lobe.

TABLE 3: ORGANIC AND CYANIDE CONCENTRATIONS IN SOIL

	SAMPLE	VOLATILE ORGANIC COMPOUNDS (mg/kg)	BASE/NEUTRAL ACID ORGANIC COMPOUNDS (mg/kg)	PESTICIDES (mg/kg)	PCBs (mg/kg)	LIBRARY SEARCH COMPOUNDS (mg/kg)	CYANIDE (mg/kg)
	Michigan Background*	NA	NA	NA	NA	NA	0.26
Site Background	MW-6 (5-7)	ND	ND	ND	ND	ND	<0.5
	MW-6 (11-11.5)	ND	ND	ND	ND	ND	<0.5
	MW-6 (11-11.5) Dup.	ND	ND	ND	ND	ND	<0.5
	BH-11 (5-7)	ND	ND	ND	ND	10	<0.5
	BH-11 (5-7) Dup.	ND	ND	ND	ND	ND	0.6
	BH-11 (8-10)	Chlorobenzene 2	ND	ND	ND	ND	<0.5
Site Samples	MW-8 (17-19)	ND	ND	ND	ND	10-20	1.5
	MW-9 (6-8)	ND	ND	ND	ND	ND	6.7
	MW-9 (20-20.5)	ND	ND	ND	ND	ND	0.8
	MW-14 (11-13)	ND	ND	ND	ND	10	2
	MW-14 (14-16)	ND	ND	ND	ND	10	3.4

\* Mean background total metals concentrations in clay in the Erie Glacial Lobe, Published by Michigan DNR (Appendix E)

NA - Not Analyzed  
ND - None Detected

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Because the native, unconsolidated glacial deposits in the vicinity consist of a silty clay, HART has chosen the mean values for metals concentrations in clay from the Erie Glacial Lobe for comparative purposes. These values as well as the three (3) site background samples are included in Table 4. Numerical values of the total metals concentrations in non-background samples are listed in Table 4 only if the particular concentrations exceed the background concentrations. Data for all metals analyses are included in Appendix D.

The majority of the total metals concentrations at the Trenton facility that exceed background levels for the Erie Lobe clay are associated with four (4) of the soil samples. Elevated total barium, cadmium, chromium, copper, iron, manganese, lead and zinc were observed in samples MW-8(17-19), MW-14(11-13), MW-14(14-16) and MW-9(6-8). Elevated total selenium concentrations were observed in samples MW-14(14-16) and MW-9(6-8) but were not associated with MW-8(17-19) or MW-14(11-13). Concentrations of total copper, iron and zinc were detected in both splits of sample BH-11(5-7) at levels only slightly exceeding background levels in the Erie Lobe clay and probably do not indicate the presence of contaminants. Elevated total mercury concentrations were associated with all of the soil samples. Concentrations in the samples ranged from 0.40 to 0.73 mg/kg with a single outstanding value of 3.3 mg/kg in sample MW-8 (17-19), as compared with a total mercury concentration of 0.04 mg/kg in the Erie Lobe clay. The occurrence of elevated mercury concentrations in all of the soil samples, including samples from background locations, indicates that the the natural mercury concentration in soils in the area of the Trenton Facility may be higher than that indicated for the Erie Lobe clay overall.

In summary, volatile and semi-volatile compounds were not observed in any of the soil sampled from borings MW-6, MW-8, MW-9 and MW-14. A single compound was detected in low concentrations in one (1) sample from boring BH-11. No PCB nor pesticide compounds were detected in any of the samples. Soil contaminants appear to be limited to cyanide and some metals and are consistently associated with samples from borings located along the Detroit River, borings MW-8, MW-9 and MW-14. The occurrence of elevated metals and cyanide in sample MW-8

TABLE 4: METALS CONCENTRATIONS IN SOIL

		TOTAL METALS (mg/kg)																						
SAMPLE		Ag	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Mg	Mn	Na	Ni	Pb	Sb	Se	Tl	V	Zn
Michigan	Background*	0.99	NA	14.7	103.1	NA	NA	1.0	12.3	24.2	19.6	21,433	0.04	NA	NA	450	NA	26.6	12.6	NA	0.43	NA	NA	50.8
Site Background	MW-6 (5-7)	<0.2	6900	2.2	37	0.26	25,000	<0.2	<1	7.4	14	15,000	0.57	730	4,600	240	660	13	14	<4	0.16	<2	11	36
	MW-6 (11-11.5)	<0.2	4000	2.5	32	<0.1	37,000	<0.2	<1	5.4	12	10,000	0.55	520	12,000	300	620	9.6	14	<4	<0.1	<2	7.2	26
	MW-6 (11-11.5) dup.	<0.2	5800	2.6	34	<0.1	41,000	<0.2	<1	6.4	15	15,000	0.5	740	12,000	75	1,100	13	16	<4	0.15	<2	9.5	30
Site Samples	BH-11 (5-7)	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	0.41	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B
	BH-11 (5-7) dup.	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	0.4	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B
	BH-11 (8-10)	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	0.43	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B
	MW-8 (17-19)	≤B	≤B	≤B	170	≤B	≤B	5.4	≤B	51	170	41,000	3.3	≤B	≤B	670	≤B	57	180	≤B	≤B	≤B	≤B	300
	MW-9 (6-8)	≤B	≤B	≤B	590	≤B	≤B	6.6	≤B	29	200	48,000	0.73	≤B	≤B	980	≤B	55	850	≤B	0.89	≤B	≤B	260
	MW-9 (20-20.5)	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	0.5	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B	≤B
	MW-14 (11-13)	≤B	≤B	≤B	610	≤B	≤B	4	≤B	57	370	78,000	0.67	≤B	≤B	1,900	≤B	240	930	≤B	≤B	≤B	≤B	150
	MW-14 (14-16)	≤B	≤B	≤B	310	≤B	≤B	5.6	≤B	30	130	39,000	0.65	≤B	≤B	940	≤B	45	320	≤B	1.5	≤B	≤B	110

\* Mean background total metals concentrations in the Erie Glacial Lobe, published by Michigan DNR (Appendix E)

≤B Less than or equal to site background concentrations



(17-19) cannot be readily explained. Earlier investigations indicated that only limited scrap and surface drum disposal took place along the northern edge of the backlot. The presence of elevated total metals and cyanide in samples from boring MW-9 and MW-14 is consistent with findings of the geophysical and excavation investigations of 1987. Significant containerized and non-containerized wastes were buried in the southeastern corner and eastern edge of the southern backlot.

#### Ground Water Analytical Data

The raw data is for the ground water analyses provided in Appendix F. Data generated for the organic and cyanide analyses is summarized in Table 5. Volatile and semi-volatile organic compounds were detected in only a few ground water samples. Phthalate compounds were detected in concentrations of 5 and 3 ug/l in samples MWD-1 and MW-2. The detection of phthalates in low concentrations is a common artifact of the analytical process. Their presence in only two samples at quite low concentration can likely be attributed to laboratory contamination.

Relatively low concentrations of vinyl chloride, 57 ug/l and 1,2-dichloroethene, 47 ug/l, were detected in ground water sampled from well MWD-9. Trichloroethene at 3 ug/l was detected in well MW-14. Tentatively identified and unknown organic compounds and molecular sulfur were detected among all of the ground water samples with the exception of samples from MW-6 and MWD-6. Concentrations were low, ranging from 10 to 90 ug/l, with a single outstanding concentration of 500 ug/l of an unknown compound in MW-1. No PCB nor pesticide compounds were detected in any of the samples.

In general, concentrations of volatile and semi-volatile compounds, as indicated by the laboratory analytical data, were quite low in comparison with field measurements obtained from the OVA. Table 6 lists the organic vapor concentrations recorded for the ground water samples obtained during packer testing. Concentrations exceeding 1000 ppm were measured in samples from both fractured and unfractured zones in core holes MWD-3, MWD-4 and MWD-14. Conversely, no volatile nor semi-volatile compounds were detected in the

TABLE 5: ORGANIC AND CYANIDE CONCENTRATIONS IN GROUND WATER

SAMPLE	VOLATILE ORGANIC COMPOUNDS (ug/l)	BASE/NEUTRAL ACID ORGANIC COMPOUNDS (ug/l)	PESTICIDES (ug/l)	PCBs (ug/k)	LIBRARY SEARCH COMPOUNDS (ug/l)	CYANIDE (mg/l)
M-1	ND	ND	ND	ND	30-500	<0.005
M-1	ND	bis (2-ethyl) phthalate 5	ND	ND	50	<0.005
M-2	ND	ND	ND	ND	10-16	0.006
M-2	ND	diethylphthalate 3	ND	ND	14	0.006
M-3	ND	ND	ND	ND	30	0.008
M-3	ND	ND	ND	ND	20	0.009
M-4	ND	ND	ND	ND	10-90	0.008
M-4	ND	ND	ND	ND	20	0.01
M-6	ND	ND	ND	ND	ND	0.006
M-6	ND	ND	ND	ND	ND	<0.005
M-8	ND	ND	ND	ND	20	0.07
M-8 Dup.	ND	ND	ND	ND	ND	NA
M-8	ND	ND	ND	ND	ND	0.009
M-8 Dup.	NA	ND	ND	ND	20	NA
M-9	ND	ND	ND	ND	20-40	0.12
M-9	vinylchloride 57 1,2-dichloroethene 47	ND	ND	ND	10-44	0.009
M-14	trichloroethene 3	ND	ND	ND	24	0.11
M-14	ND	ND	ND	ND	30	0.11

ND - None Detected

NA - Not Analyzed

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TABLE 6: ON-SITE ORGANIC VAPOR CONCENTRATIONS IN GROUND WATER

<u>WELL</u>	<u>DEPTH</u>	<u>DESCRIPTION</u>	<u>OVA (ppm)</u>
MWD-1	14'-21'	sl, fractured, mod to sieve, solutioning and weathering.	25
	21'-26.5'	v. sl, solutioning and weathering.	70
MWD-2	15'-21'	fractured, severely solutioned and weathered.	80
	21'-27'	sl. fractured and weathered.	70
MWD-3	17'-25'	sl, fractured, sl to mod. solutioning and weathering.	1,000+
	25'-30'	sl, fractured.	1,000+
MWD-4	17'-25'	fractured, sl. solutioning and weathering.	1,000+
	25'-31'	fractured sl to mod solutioning and weathering.	1,000+
MWD-6	13'-20'	sl, fractured, sl to mod. solutioning and weathering	22
	20'-26'	sl, fractured sl solutioning and weathering.	600
MWD-14	23'-30'	fractured, sl to mod. solution- ing and weathering	1,000+
	30'-36.5'	fractured, severely solutioned and weathered.	1,000+

NOTE: 1,000+ indicates that the concentration recorded exceeded the OVA's upper limit of One Thousand parts per million organic vapors.

laboratory analysis performed upon ground water sampled from those wells upon their completion.

It is possible that the ground water samples collected during the packer testing may have been contaminated by the pump or that methane might be responsible for the high organic vapor concentrations. While the disparity cannot be readily explained, the data generated by laboratory analysis can definitely be identified as the superior product in terms of quality and precision. All sample collection and handling for the laboratory analyses, including preservation and chain-of-custody requirements, were conducted according to strict EPA protocol. Analyses were performed within the recommended holding times for water. Wadsworth/Alert Laboratories, Inc. is an EPA approved laboratory for the performance of Contract Laboratory Protocols which are the highest quality standards recognized. As a part of Wadsworth's standard program, all analytical performance and data is subject to rigorous internal quality assurance/quality control checks. All of the ground water data passed Wadsworth's control standards and HARTs data validation check.

On the other hand, field instrumentation generally cannot produce the same degree of precision as laboratory instrumentation and virtually no quality checks can be performed upon field instrument analyses and data. In light of these facts and the proven validity of the laboratory data, the laboratory data will solely be considered to define the quality of ground water in this study.

Cyanide concentrations in ground water were generally low for the majority of the samples, ranging from  $<0.005$  to  $0.01$  mg/l. Slightly elevated cyanide concentrations of  $0.07$  to  $0.12$  mg/l were detected in ground water from wells MW-8, MW-9, MW-14 and MWD-14. Elevated cyanide concentrations in soil were observed in samples from the same borings, MW-8, MW-9 and MW-14, indicating that there is a direct correlation between the presence of cyanide in soil and in ground water.

A summary of the metals data is presented in Table 7. Where no values are reported, the concentrations were below the criteria used. Criteria used include Federal Primary and Secondary Drinking Water Standards for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, copper,

TABLE 7: METALS CONCENTRATIONS IN GROUND WATER

SAMPLE	TOTAL METALS (mg/l)*																	Pb	Sb	Se	Sn	Tl	V	Zn
	Ag	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cr <sup>6</sup>	Cu	Fe	Hg	K	Mg	Mn	Na							
						1300						1.3		8.2	220	1.8	180	0.06						
MW-1	<0.01	3.5								NA				87		0.19	190							
MWD-1		0.11								NA		3.0		11		0.19	150							
MW-2		1.9								NA				9		0.05	160							
MWD-2												0.38		16		0.22								
MW-3		0.1		5.3								2.5		11		0.05								
MWD-3		1.7										1.1		1.6		0.71								
MW-4		0.69										0.44		11		0.16	210	0.04						
MWD-4		0.11										0.73		2.6		0.58	670							
MW-6		0.32												1.9		0.17	300							
MWD-6		0.18										4.5		30		0.46		0.12						
MW-8		1												51			1,300							
MWD-8		0.29	0.2				0.01					7.1		32		0.24	110	0.07						
MW-9		1.5		7.0								0.9		70			110							
MWD-9		0.42										8.2		46		0.24		0.04						
MW-14		1.5		1.8										40		0.07		0.05						
MWD-14		0.11																						

\* Numerical values shown when concentrations exceed criteria concentrations.

Criteria include:

- Federal Primary and Secondary Drinking Water Standards for As, Ba, Cd, Cr, Pb, Hg, Se, Ag.
- Michigan Environmental Health Association recommended drinking water levels for Ca, Mg, Na.
- Detection levels for all remaining metals (Al, Be, Co, Cr<sup>6</sup>, K, Ni, Sn, Tl, V).

NA-Not Analyzed

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iron, manganese and zinc and Michigan Environmental Health Association Recommended Drinking Water Levels for calcium, 250 mg/l, magnesium, 150 mg/l and sodium, 100 mg/l. In the absence of established maximum levels for the other metals, including aluminum, beryllium, cobalt, hexavalent chromium, potassium, nickel, tin, thallium and vanadium, the reported values have been shown in Table 7 when concentrations exceeded the detection limit. Analytical Data for groundwater samples is included in Appendix F.

No outstanding trends were observed for metals concentrations in ground water samples from specific wells or well pairs. However, certain metals were elevated in many of the samples. Specifically, total aluminum, iron, manganese and sodium were elevated above the respective criteria in well over half the ground water samples indicating that these constituents may be elevated in ground water in the region, rather than as a result of waste disposal practices at the Trenton Chemical Facility.

However, a small number of elevated total metals concentrations may be associated with waste disposal at the facility. Elevated total barium concentrations were observed in MW-3, MW-9 and MW-14. Elevated barium in ground water from well MW-3 may be related to the nearby water retention ponds. Elevated total barium concentrations in wells MW-9 and MW-14 are consistent with elevated total barium concentrations in soil sampled from those borings and is likely associated with past waste disposal. Concentrations of total aluminum and iron were significantly higher in samples from MW-9 and MW-14 occurring at levels 3 to 10 times higher than observed in the other samples. Total nickel concentrations at or above the detection level of 0.04 mg/l were observed in ground water samples from wells MWD-4, MW-8, MW-9, MW-14 and MWD-14. The concentrations reported are only slightly elevated above the detection level and may not be associated with past waste disposal.

The ground water sample from well MW-8 exhibited several peculiar elevated metals concentrations not observed in the other wells, such as a total arsenic concentration of 0.2 mg/l, cadmium at 0.01 mg/l and sodium at a significantly elevated 1,300 mg/l.

HART conducted a file search for local hydrogeologic and ground water quality data. While examining the files at the DNR's Northville office, an Interoffice Communication between Michigan DNR staff, dated September 14, 1983, was discovered. It stated that ground water below the Monsanto treatment lagoons is mounded and that ground water flows radially from some central point below the lagoons. Furthermore, the communication stated that while the lagoons were lined with clay, the clay might not be completely impervious. Given well MW-8's close proximity to Monsanto's lagoons, and radial ground water flow, it seems quite likely that contaminated ground water in the vicinity of well MW-8 may be a result of migration from Monsanto's lagoons.

In summary, ground water quality in the vicinity of Trenton Chemical has only been impacted slightly and is generally limited to areas downgradient of former waste disposal sites in the backlot. Ground water contamination is limited to low levels of a few volatile organic compounds and elevated concentrations of barium, iron and aluminum.

Analytical data for the soils is generally consistent with the ground water quality data. No PCB or pesticide compounds were detected in either the soil or water samples. No volatile nor semi-volatile hazardous substance list compounds were detected in the soil samples while low concentrations of a few volatile organic compounds were detected in two (2) of the existing fourteen (14) monitoring wells. The presence of volatile organics in ground water while not present in soil is probably due to the solubility and mobility of those compounds and is not surprising.

Elevated metals concentrations were reported in both soil and ground water samples obtained from the backlot area. The occurrence of more consistent and higher total metals concentration in soil as opposed to ground water is related to the solubility and mobility of metals. It is typical that under average pH soil conditions (pH - 5.0 to 7.0), metals tend to remain out of solution and are taken up by cation exchange sites, particularly in clayey soils.

Elevated cyanide concentrations were observed in soil and ground water samples from the backlot area also. The presence of elevated cyanide concentrations in soil correlated closely with the detection of slightly elevated cyanide concentrations in ground water. As with metals, cyanide tends to remain in soil, accounting for the low detections in ground water.

In general, the extensive soils and ground water analytical data reveals no inconsistencies that might indicate a shortcoming with the investigatory approach or unusual geologic or hydrogeologic conditions. Constituents detected in site soils and ground water indicate that environmental impact is limited to the backlot area in the vicinity of areas of past waste disposal.



## 6.0 CONCLUSIONS

Geologic and hydrogeologic data collected during Phase I of the Trenton Chemical Site Investigation has indicated that there are two (2) principal geologic units of interest immediately underlying the subject manufacturing facility. These units are of particular importance because they comprise the geologic materials through which ground water is flowing in the study area and because an understanding of these units is necessary in order to evaluate potential waste constituent migration from source areas.

The geologic units are the Detroit River Group of bedrock, comprised of dolomite and dolomite limestone and the overlying geologically younger glacial deposits and fill. Glacial deposits consist of silty to sandy clay with coarse rock fragments and fill materials consisting of soil and a variety of construction and demolition debris.

Regional data and site specific observations indicate that ground water flow underlying the study area is primarily through void spaces in the glacial and fill materials and through fractures and solution voids in the bedrock. The pathways or permeability of the various geologic materials varies considerably from location to location, however, the permeability of the bedrock within the upper 10 to 15 feet of rock appears to be greatest near the river because of increased fracturing. Similarly, the permeability of the unconsolidated material is generally greater near the river because most of the material adjacent to the river is poorly compacted construction and demolition debris as opposed to the native geologic materials and more compacted fill materials existing further west of the backlot area underlying the manufacturing facilities.

Ground water data further indicates that the ground water flow system is under unconfined or water table conditions and the fractured rock and overlying unconsolidated material are in direct hydraulic communication and behave essentially as one (1) aquifer.

Information collected in order to delineate the hydraulic gradient indicated that a ground water high is located in the center of the Trenton

Chemical Facility and hydraulic gradients slope to the west-northwest and east-southeast from this area. This indicated that ground water is flowing from the central portion of the facility through the backlot and discharging to the Detroit River during the period of the investigation. Historical information on river stage does show a mean increase in river elevation since 1960 of approximately three (3) feet, however, without corresponding ground water elevation data, it is not possible to determine the influence fluctuations in river stage may have had upon the ground water flow system underlying the subject study area. Additional seasonal data, however may provide some information on the influence of river stage fluctuations and their effect on ground water flow.

Water quality data from monitoring wells installed during Phase I generally indicate minor impacts from the waste disposal area on ground water quality. Impacts to ground water quality appear to be limited to the backlot as indicated by downgradient monitoring wells 8, 9, and 14. The analytical data, however, is consistent with the hydraulic gradient in the area. Low concentrations of a few volatile organic compounds and some metals have been observed in monitoring wells sampled in the backlot and one (1) Boring (BH-11) located near Jefferson Avenue. The presence of one (1) volatile organic compound in Boring BH-11 may be related to the nearby drum marshalling area and is unrelated to waste disposal practices in the backlot.

Constituents detected in soil and ground water in the backlot at MW-9 and MW-14 are likely the result of migration from the previously delineated disposal areas located in the southern portion of the backlot. Analytical data also indicates the presence of some waste constituents near MW-8 in the northern portion of the backlot. However, the source area investigation conducted in 1987 did not identify any units of past waste disposal in the northern backlot.

While the majority of waste constituents similar to those identified during the source area investigation were detected in the unconsolidated material, some constituents were detected in bedrock. Waste constituents may be preferentially migrating in the unconsolidated material in areas of greater permeability. These pathways may be very localized and limited in lateral

extent as previous investigations on-site have indicated. Where avenues of high permeability are in communication with fractured bedrock, transport through fractures and weathered solution voids is occurring accounting for the presence of volatile organic compounds in MWD-9. Eventual discharge of ground water from unconsolidated material and bedrock to the Detroit River is probably occurring during periods of normal and low river stage. During brief seasonal periods of high river stage, migration and discharge of ground water and waste constituents is probably attenuated, reoccurring once the river stage drops on a seasonal basis.

## 7.0 RECOMMENDATIONS

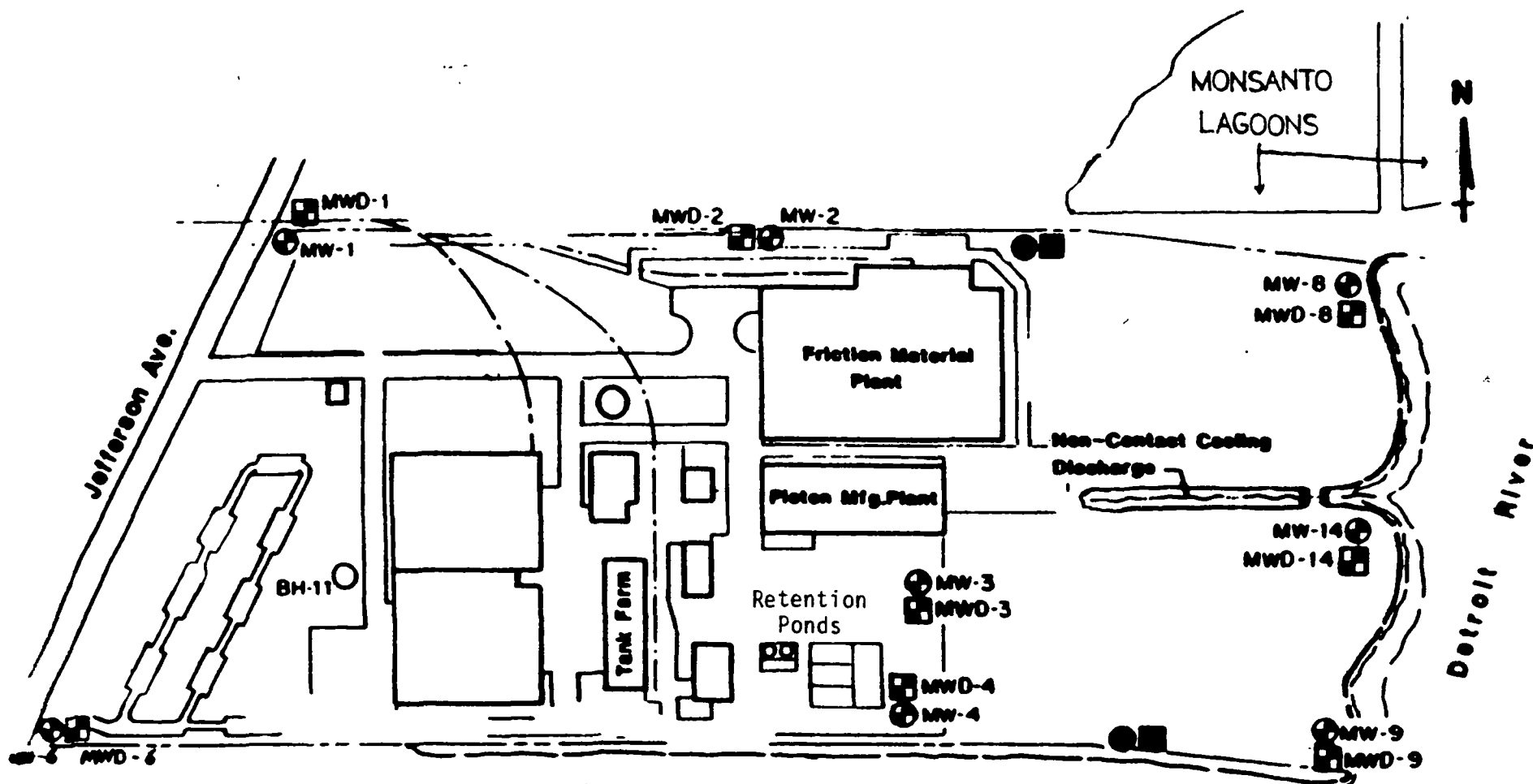
HART recommends that the second phase of the hydrogeologic investigation concentrate on the backlot area. Although the hydrogeologic regime in the western portion of the site is not thoroughly understood, waste migration is not occurring in that area. Instead HART recommends obtaining additional hydrogeologic and water quality data in the backlot area to confirm the limited extent of waste migration and impact upon ground water quality observed presently.

Specifically, two (2) additional well pairs are proposed to be installed in the backlot area (Figure 1). The dip of bedrock and the hydraulic gradient toward the river along the southern edge of the property indicates that migration and discharge to the river may be occurring in that area. HART proposes installing a nested well pair in the unconsolidated material and bedrock in that area approximately midway between wells MW-4 and MW-9, to assess the apparent hydraulic gradient and water quality in that area. In order to gain a better understanding of ground water flow in the central and northern portion of the backlot and how it may be influenced by Monsanto's treatment lagoons, HART proposes installing a well pair near the northern property boundary, approximately midway between wells MW-2 and MW-8.

In order to generate new data that can be readily compared to the existing data, drilling and well construction and sampling specifications employed should be identical to those performed under Phase I. Additionally, ground water and river stage elevation data should continue to be collected on a regular basis in order to further our understanding of the influence of Detroit River stages upon ground water in the area and to develop historical data.

# CHRYSLER CHEMICAL DIVISION

Trenton Michigan



## LEGEND

- Phase I Boring
- ⊕ Existing Shallow Well
- ⊞ Existing Deep Well

## Proposed Phase II Activities

- Shallow Well
- Deep Well

Figure 1: Phase II Proposed Well Locations